

Patent Claims

1. Casting mold for metallic foundry or for precision casting of fine parts, wherein the casting mold is produced by a generative rapid prototyping process and is mainly comprised of a porous ceramic in the green or sintered state,  
thereby characterized,  
that the thermal coefficient of expansion of the ceramic is above approximately  $7.5 \times 10^{-6} \text{K}^{-1}$  and that the ceramic is comprised of coated ceramic coarse particles and sinterable ceramic fine particles,  
wherein the sintering temperature of the fine particles is at least 50°C below that of the coarse particles.
2. Casting mold according to Claim 1, thereby characterized, that the main part of the casting mold is comprised of at least one insert and/or a mold core.
3. Casting mold according to Claim 1 or 2, thereby characterized, that the casting mold includes reinforcing ribs produced using a generative rapid prototyping process.
4. Casting mold according to one of the preceding claims, thereby characterized, that at least during casting the casting mold is back-fed with a fill of ceramic material.
5. Casting mold according to one of the preceding claims, thereby characterized, that the generative prototyping process is 3D-binder printing or 3D-laser sintering.

6. Casting mold according to one of the preceding claims, thereby characterized, that the porous ceramic includes as main component aluminum oxide, zirconium oxide, magnesium silicate, spinel and/or magnesium oxide.
7. Casting mold according to one of the preceding claims, thereby characterized, that the porous ceramic includes 0.5 to 10 wt. % organic binder.
8. Use of casting molds according to one of the preceding Claims 1 through 7 for precision casting of metal alloys with an average thermal coefficient of expansion, over the temperature interval of 0 to 800°C, in the range of 5 to  $14 \cdot 10^{-6} \text{K}^{-1}$ .
9. Use of casting molds according to one of the preceding Claims 1 through 7 for ingot casting, shell casting or precision casting of steel, Fe/Ni- or Fe/Ni/Co- or Ni-alloys.
10. Process for producing a green casting mold according to Claim 1, comprising repeating sequence of the steps
  - a) applying a layer of particles, using a dispensing device, onto a substrate;
  - b) flattening the applied layer with a flatten device;
  - c) hardening the layer in defined areas
    - by adhering the particles under the influence of binder liquid,

- or by melting or sintering the particles under the influence of intensive radiation,

wherein the majority of the particles have an average thermal coefficient of expansion of above approximately  $7.5 \times 10^{-6} \text{K}^{-1}$ , wherein the ceramic is comprised of coated ceramic coarse particles and sinterable ceramic fine particles, and wherein the sintering temperature of the fine particles is at least 50°C below that of the coarse particles.

11. Process according to Claim 10, thereby characterized, that at least the coarse particles are coated with organic polymers.
12. Process according to Claim 10 or 11, thereby characterized, that the green casting mold is converted into a porous casting mold by ceramic firing.
13. Process according to one of Claim 10 through 12, thereby characterized, that in the green or ceramic casting mold at least one mold core and/or insert of green and/or fired ceramic is employed based on  $\text{MgO}$ ,  $\text{ZrO}_2$ , spinel, and/or  $\text{Al}_2\text{O}_3$ .
14. Process according to Claim 10, thereby characterized, that the green casting mold is a mold core or insert, which while in the green or fired state is inserted or introduced into a support or casing mold, whereby an composite casting mold is formed.

15. Process according to Claim 14, thereby characterized, that the support or reinforcing or casing mold includes foundry sand based on  $\text{SiO}_2$ , silicates or zircon.
16. Powder mixtures for producing introduced or cast molds using a generative rapid prototyping process according to Claim 10, thereby characterized, that the powder mixture includes coated ceramic coarse particles and sinterable ceramic fine particles, wherein the sintering temperature of the fine particles is at least  $50^\circ\text{C}$  below that of the coarse particles.
17. Powder mixture according to Claim 16, thereby characterized, that the coating is comprised essentially of polymers which are readily soluble in organic solvent.
18. Powder mixture according to Claim 16 or 17, thereby characterized, that the ceramic coarse particles include oxides of the elements Mg, Al and/or Zr, and the ceramic fine particles are comprised essentially of  $\text{SiO}_2$ , and/or silicates.
19. Use of casting molds according to one of Claim 1 through 7 for production of tools or tool components for die casting, injection molding or forging machines.
20. Use of casting molds according to one of Claim 1 through 7 for production of tools or tool components having cooling channels.